**WHAT IS CLAIMED IS:**

1. A system for monitoring the effect of extracellular chemical stimuli on the translational motion of cells, the system comprising:

(a) an array of one or more cell containment volumes;

(b) an array of one or more chemical agent volumes interspersed among the array of one or more cell containment volumes;

(c) one or more substantially planar sensing electrodes distributed within the arrays of cell containment volumes and chemical agent volumes so that at least one of the sensing electrodes is between one cell containment volume and one chemical agent volume, wherein the one or more sensing electrodes is operatively coupled to a sensing device capable of measuring an electrical parameter of the sensing electrode;

(d) at least one counter electrode in electrical connection with the one or more sensing electrodes; and

(e) a biocompatible chemical gradient stabilizing medium in simultaneous diffusional contact with the arrays of cell containment volumes and chemical agent volumes.

2. The system of claim 1 further comprising a reference electrode in electrical connection to the at least one counter electrode and the one or more sensing electrodes.

3. The system of claim 1, wherein the measured electrical parameter of the sensing electrode is impedance.

4. The system of claim 1, wherein the chemical gradient stabilizing medium is in a planar geometry overlying the arrays of cell containment volumes and chemical agent volumes.

5. The system of claim 1, wherein the surface area of each of the one or more sensing electrodes is from about $0.5 \times 10^{2}$ mm $^{2}$ to about $10 \times 10^{2}$ $mm^{2}$.

6. The system of claim 1, wherein the sensing device is operatively coupled to a microprocessor.

7. The system of claim 6, wherein the microprocessor is under the control of a software program executable on the microprocessor.

8. A method for monitoring the translational motion of cells in response to extracellular chemical stimuli, the method comprising the steps of:

(a) placing a population of one or more cells in a biocompatible medium into a cell containment volume;

(b) placing a chemical agent in a biocompatible medium into a chemical agent volume in diffusional contact with a biocompatible chemical gradient stabilizing medium; and

(c) monitoring changes in an electrical parameter of one or more substantially planar sensing electrodes interposed between the cell containment volume and the chemical agent volume and in electrical connection with a counter electrode, wherein the changes in electrical parameter of the one or more sensing electrodes arise substantially from contact of one or more cells from the cell population with a surface of one or more of the sensing electrodes, and wherein the one or more cells have diffused to the surface of one or more of the sensing electrodes from the cell containment volume under the influence of a chemical gradient of the chemical agent in the chemical gradient stabilizing medium.

9. The method of claim 8, wherein the translational movement of the one or more cells is directionally focused.

10. The method of claim 8, wherein the translational movement of the one or more cells is not directionally focused.

11. The method of claim 8, wherein there is additionally interposed between the cell containment volume and the one or more sensing electrodes one or more barriers to translational motion of the cells.

12. The method of claim 8, wherein the one or more cells are exposed to two or more independent chemical gradients from different chemical agents.

13. The method of claim 8, wherein the cells of the cell population are selected from the group consisting of *D. discoideum*, bone marrow cells from BALB/c mice, M1 cells, and U937 cells.

14. The method of claim 8, wherein the cells of the cell population are obtained from tissue culture.

15. The method of claim 8, wherein the cells of the cell population are obtained from living animals.

16. The method of claim 8, wherein the chemical agent is selected from the group consisting of folic acid, guinea pig serum, activated complement, bacterial peptides, and mammalian chemokines.

17. A method for determining the impact of a test substance on the ability of a chemical agent to affect the translational movement of cells, the method comprising the steps of:

(a) placing a population of one or more cells in a biocompatible medium into a cell containment volume;

(b) placing a chemical agent in a biocompatible medium into a chemical agent volume in diffusional contact with a biocompatible chemical gradient stabilizing medium;

(c) exposing one or more cells of the population to a first test substance;

(d) monitoring one or more electrical parameters measured on a substantially planar sensing electrode positioned between the cell containment volume and the chemical agent volume, wherein the changes in impedance on the sensing electrode arise substantially from contact of one or more cells from the cell population with a surface of the sensing electrode, and wherein the one or more cells have diffused to the surface of the sensing electrode from the cell containment volume under the influence of a chemical

gradient of the chemical agent in the chemical gradient stabilizing medium between the cell containment volume and the chemical agent volume; and

(e) comparing the one or more electrical parameters measured in step (d) with electrical parameter measurements taken for one or more cells from the population that have not been exposed to the test substance.

18. The method of claim 17, wherein the method involves the further steps of exposing the cells to a second test substance and comparing the resulting measured electrical parameter with electrical parameter measurements taken for one or more cells from the population that have been exposed to the first test substance but not to the second test substance.

19. A system for the non-optical imaging of translational cell movement comprising:

(a) one or more cell containment volumes;

(b) one or more chemical agent volumes;

(c) a plurality of sensing electrodes interposed between the cell containment volumes and the chemical agent volumes, wherein each of the plurality of sensing electrodes is operatively coupled to a sensing device capable of measuring an electrical parameter of the sensing electrode;

(d) at least one counter electrode in electrical connection with the array of sensing electrodes; and

(e) a biocompatible chemical gradient stabilizing medium in simultaneous diffusional contact with the cell containment volumes and the chemical agent volumes.

20. The system of claim 19, wherein the surface area of each of the one or more sensing electrodes is less than about $1 \times 10^{-6}$ $cm^2$.